

CLAIMS

WHAT IS CLAIMED IS:

- 1           1. A planar lightwave circuit comprising:  
2               a first portion of a waveguide;  
3               a second portion of waveguide; and  
4               a segment of crystal core fiber coupling the first portion of the waveguide  
5               with the second portion of the waveguide.
- 1           2. The planar lightwave circuit of claim 1 further comprising:  
2               an optical index-matching gel disposed between the segment of crystal core  
3               fiber and the first portion and second portion of the waveguide.
- 1           3. The planar lightwave circuit of claim 1, wherein the segment of crystal core  
2           fiber has a principal optical axis disposed at approximately a 45-degree angle with the  
3           planar lightwave circuit.  
4
- 1           4. The planar lightwave circuit of claim 1, wherein the planar lightwave circuit is  
2           an array waveguide grating.

1           5. The planar lightwave circuit of claim 4, wherein the segment of crystal core  
2 fiber is disposed at a mid section of the array waveguide grating.

1           6. The planar lightwave circuit of claim 5, wherein the segment of crystal core  
2 fiber is disposed in a V-groove substrate.

1           7. The planar lightwave circuit of claim 4, wherein the segment of crystal core  
2 fiber has a length that satisfies the equation  $(2m+1) * \lambda / (2 * \Delta n)$ , wherein m is any non-  
3 negative integer,  $\lambda$  is a wavelength of an optical signal in an optical communication  
4 waveband range, and  $\Delta n$  is a measure of birefringence of the segment of crystal core  
5 fiber.

1           8. The planar lightwave circuit of claim 7, wherein the optical communication  
2 waveband range is approximately 800 nm to 1700 nm.

1           9. The planar lightwave circuit of claim 7, wherein the segment of crystal core  
2 fiber comprises quartz, lithium niobate, lithium borate, beta-barium borate or other  
3 inorganic substance.

1           10. The planar lightwave circuit of claim 7, wherein the segment of crystal core  
2 fiber comprises an organic or polymeric substance.

1           11. An array waveguide grating comprising:  
2           a plurality of waveguides;

3 a V-groove portion of substrate having multiple segments of crystal core  
4 fibers inserted into a section of the plurality of waveguides.

1 12. The array waveguide grating of claim 11 further comprising:  
2 an optical index-matching gel disposed at ends of the multiple segments of  
3 crystal core fibers.

1 13. The array waveguide grating of claim 11, wherein the V-groove portion of  
2 substrate is inserted at a midway point of the array waveguide grating.

1 14. A method of correcting for birefringence in a planar lightwave circuit, the  
2 method comprising:  
3 removing a section of the planar lightwave circuit; and  
4 inserting a portion of crystal core fiber into the planar lightwave circuit.

1 15. The method of claim 14, wherein inserting the portion of crystal core fiber  
2 further comprises:  
3 positioning the portion of crystal core fiber to have approximately a 45-  
4 degree angle between an optical axis of the portion of crystal core fiber  
5 and a substrate plane of the planar lightwave circuit.

1 16. The method of claim 15 further comprising:  
2 inserting an index-matched gel between the portion of crystal core fiber and  
3 the planar lightwave circuit.

1 17. The method of claim 14, wherein the portion of crystal core fiber is disposed  
2 in a V-groove substrate.

1 18. The method of claim 17, wherein other portions of crystal core fiber are also  
2 disposed in the V-groove substrate.

1 19. A method of correcting for birefringence in a planar waveguide, the method  
2 comprising:  
3 directing an optical signal down a first segment of the planar waveguide;  
4 changing a polarization of the optical signal by directing the optical signal  
5 through a portion of crystal core fiber; and  
6 directing the optical signal down a second segment of the planar waveguide.

1 20. The method of claim 19 further comprising:  
2 reducing loss of the optical signal between an interface of the portion of  
3 crystal core fiber and the planar waveguide by using an index-matched  
4 gel.

1 21. The method of claim 19, wherein the length of the portion of crystal core fiber  
2 satisfies the equation  $(2m+1) * \lambda / (2 * \Delta n)$ , wherein  $m$  is a non-negative integer,  $\lambda$  is a  
3 wavelength of the optical signal, and  $\Delta n$  is a measure of birefringence of the portion of  
4 crystal core fiber.

- 1            22. The method of claim 21, wherein  $\lambda$  is in an optical waveband range of
- 2            approximately 800 nm to 1700 nm.

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